WHAT IS CLAIMED IS:

1. A quantum semiconductor device comprising:

a first semiconductor layer formed on a substrate and having a two-dimensional carrier gas formed in;

a quantum dot formed on the first semiconductor layer;

a second semiconductor layer formed on the first semiconductor layer, covering the quantum dot;

a dot-shaped structure formed on the surface of the second semiconductor layer at a position above the quantum dot; and

an oxide layer formed on two sides of the dot-shaped structure on the surface of the second semiconductor layer.

2. A quantum semiconductor device according to claim 1, wherein

the dot-shaped structure is caused to form on the surface of the second semiconductor layer at a position above the quantum dot due to crystal strains generated in the surface of the second semiconductor layer due to the presence of the quantum dot.

3. A quantum semiconductor device according to claim 1, wherein

the quantum dot is in a three-dimensionally grown island self-assembled by S-K mode.

4. A quantum semiconductor device according to claim 1, wherein

the dot-shaped structure is in a three-dimensionally grown island self-assembled by S-K mode.

5. A quantum semiconductor device according to claim 1, wherein

a depletion region is formed due to the presence of the oxide layer in a region of the first semiconductor layer, which is below the oxide layer, and

a channel region is defined by the depletion region.

6. A quantum semiconductor device according to claim 5, further comprising:

source/drain regions connected to both ends of the channel region.

7. A quantum semiconductor device according to claim 1, further comprising:

a gate electrode connected to the dot-shaped structure.

8. A quantum semiconductor device according to claim 1, wherein

a distance between the two-dimensional carrier gas and the quantum dot is 5 nm or less.

9. A quantum semiconductor device according to claim 1, wherein

the dot-shaped structure is in another quantum dot or an anti-dot.

10. A quantum semiconductor device according to claim 1, wherein

at least a part of the dot-shaped structure is oxidized.

11. A method for fabricating a quantum semiconductor device comprising the steps of:

forming on a substrate a first semiconductor layer with a two-dimensional carrier gas formed in;

forming a quantum dot on the first semiconductor layer;

forming a second semiconductor layer, covering the quantum dot;

forming a dot-shaped structure on the surface of the second semiconductor at a position above the quantum dot due to strains generated in the surface of the second semiconductor layer due to the presence of the quantum dot; and

forming an oxide layer on the surface of the second semiconductor layer on both side of the dot-shaped structure with the dot-shaped structure as a mark.

12. A method for fabricating a quantum semiconductor device according to claim 11, further comprising, after the step of forming the oxide layer,

the step of forming source/drain regions with the oxide layer as a mark.

13. A method for fabricating a quantum semiconductor device according to claim 11, wherein

in the step of forming the quantum dot, the quantum dot in a three-dimensional grown island is self-assembled by S-K mode.

14. A method for fabricating a quantum semiconductor device according to claim 11, wherein

in the step of forming the dot-shaped structure, the dot-shaped structure in a three-dimensional grown island is

self-assembled by S-K mode.

15. A method for fabricating a quantum semiconductor device according to claim 11, wherein

in the step of forming an oxide layer, the oxide layer is formed by bringing a needle-shaped conductor close to the surface of the second semiconductor layer and applying a voltage between the needle-shaped conductor and the substrate.

16. A method for fabricating a quantum semiconductor device according to claim 15, wherein

the needle-shaped conductor is a probe of an atomic force microscope.